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A balanced equation is an equation for a chemical reaction in which the number of atoms for each element in the reaction and the total charge is the same for both the reactants and the products. In other words, the mass and the charge are balanced on both sides of the reaction. Also Known As: Balancing the equation, balancing the reaction, conservation of charge and mass. An unbalanced chemical equation lists the reactants and products in a chemical reaction but doesn't state the amounts required to satisfy the conservation of mass. For example, this equation for the reaction between iron oxide and carbon to form iron and carbon dioxide is unbalanced with respect to mass: $\text{Fe}_2\text{O}_3 + \text{C} \rightarrow \text{Fe} + \text{CO}_2$ The equation is balanced for charge because both sides of the equation have no ions (net neutral charge). The equation has 2 iron atoms on the reactants side of the equation (left of the arrow) but 1 iron atom on the products side (right of the arrow). Even without counting up the quantities of other atoms, you can tell the equation isn't balanced. The goal of balancing the equation is to have the same number of each type of atom on both the left and right sides of the arrow. This is achieved by changing the coefficients of the compounds (numbers placed in front of compound formulas). The subscripts (small numbers to the right of some atoms, as for iron and oxygen in this example) are never changed. Changing the subscripts would alter the chemical identity of the compound. The balanced equation is: $2 \text{Fe}_2\text{O}_3 + 3 \text{C} \rightarrow 4 \text{Fe} + 3 \text{CO}_2$ Both the left and right sides of the equation have 4 Fe, 6 O, and 3 C atoms. When you balance equations, it's a good idea to check your work by multiplying the subscript of each atom by the coefficient. When no subscript is cited, consider it to be 1. It's also good practice to cite the state of matter of each reactant. This is listed in parentheses immediately following the compound. For example, the earlier reaction could be written: $2 \text{Fe}_2\text{O}_3(\text{s}) + 3 \text{C}(\text{s}) \rightarrow 4 \text{Fe}(\text{s}) + 3 \text{CO}_2(\text{g})$ where s indicates a solid and g is a gas. In aqueous solutions, it's common to balance chemical equations for both mass and charge. Balancing for mass produces the same numbers and kinds of atoms on both sides of the equation. Balancing for charge means the net charge is zero on both sides of the equation. The state of matter (aq) stands for aqueous, meaning only the ions are shown in the equation and that they are in the water. For example: $\text{Ag}^+(\text{aq}) + \text{NO}_3^-(\text{aq}) + \text{Na}^+(\text{aq}) + \text{Cl}^-(\text{aq}) \rightarrow \text{AgCl}(\text{s}) + \text{Na}^+(\text{aq}) + \text{NO}_3^-(\text{aq})$ Check that an ionic equation is balanced for the charge by seeing if all the positive and negative charges cancel each other out on each side of the equation. For example, on the left side of the equation, there are 2 positive charges and 2 negative charges, which means the net charge on the left side is neutral. On the right side, there is a neutral compound, one positive, and one negative charge, again yielding a net charge of 0. Printed from [Instructions on balancing chemical equations](#): Enter an equation of a chemical reaction and click 'Balance'. The answer will appear below. Always use the upper case for the first character in the element name and the lower case for the second character. Examples: Fe, Au, Co, Br, C, O, N, F. Compare: Co - cobalt and CO - carbon monoxide To enter an electron into a chemical equation use (-) or e To enter an ion, specify charge after the compound in curly brackets: {+3} or {3+} or {3}. Example: $\text{Fe}\{3+\} + \text{I}\{-\} = \text{Fe}\{2+\} + \text{I}_2$ Substitute immutable groups in chemical compounds to avoid ambiguity. For instance equation $\text{C}_6\text{H}_5\text{C}_2\text{H}_5 + \text{O}_2 = \text{C}_6\text{H}_5\text{OH} + \text{CO}_2 + \text{H}_2\text{O}$ will not be balanced, but $\text{PhC}_2\text{H}_5 + \text{O}_2 = \text{PhOH} + \text{CO}_2 + \text{H}_2\text{O}$ will Compound states [like (s) (aq) or (g)] are not required. If you do not know what products are, enter reagents only and click 'Balance'. In many cases a complete equation will be suggested. Reaction stoichiometry could be computed for a balanced equation. Enter either the number of moles or weight for one of the compounds to compute the rest. Limiting reagent can be computed for a balanced equation by entering the number of moles or weight for all reagents. The limiting reagent row will be highlighted in pink. Examples of complete chemical equations to balance: Examples of the chemical equations reagents (a complete equation will be suggested): Related chemical tools: Molar mass calculator pH solver chemical equations balanced today Please let us know how we can improve this web app. A chemical equation is a written description of what happens in a chemical reaction. The starting materials, called reactants, are listed on the lefthand side of the equation. Next comes an arrow that indicates the direction of the reaction. The righthand side of the reaction lists the substances that are made, called products. A balanced chemical equation tells you the amounts of reactants and products needed to satisfy the Law of Conservation of Mass. Basically, this means there are the same numbers of each type of atoms on the left side of the equation as there are on the right side of the equation. It sounds like it should be simple to balance equations, but it's a skill that takes practice. So, while you might feel like a dummy, you're not! Here's the process you follow, step by step, to balance equations. You can apply these same steps to balance any unbalanced chemical equation... Follow four easy steps to balance a chemical equation. Write the unbalanced equation to show the reactants and products. Write down how many atoms of each element there are on each side of the reaction arrow. Add coefficients (the numbers in front of the formulas) so the number of atoms of each element is the same on both sides of the equation. It's easiest to balance the hydrogen and oxygen atoms last. Indicate the state of matter of the reactants and products and check your work. The first step is to write down the unbalanced chemical equation. If you're lucky, this will be given to you. If you're told to balance a chemical equation and only given the names of the products and reactants, you'll need to either look them up or apply rules of naming compounds to determine their formulas. Let's practice using a reaction from real life, the rusting of iron in the air. To write the reaction, you need to identify the reactants (iron and oxygen) and the products (rust). Next, write the unbalanced chemical equation: $\text{Fe} + \text{O}_2 \rightarrow \text{Fe}_2\text{O}_3$ Note the reactants always go on the left side of the arrow. A "plus" sign separates them. Next, there is an arrow indicating the direction of the reaction (reactants become products). The products are always on the right side of the arrow. The order in which you write the reactants and products is not important. The next step for balancing the chemical equation is to determine how many atoms of each element are present on each side of the arrow: $\text{Fe} + \text{O}_2 \rightarrow \text{Fe}_2\text{O}_3$ To do this, keep in mind a subscript indicates the number of atoms. For example, O_2 has 2 atoms of oxygen. There are 2 atoms of iron and 3 atoms of oxygen in Fe_2O_3 . There is 1 atom in Fe. When there is no subscript, it means there is 1 atom. On the reactant side: 1 Fe 2 O On the product side: 2 Fe 3 O How do you know the equation isn't already balanced? Because the number of atoms on each side isn't the same! Conservation of Mass states mass isn't created or destroyed in a chemical reaction, so you need to add coefficients in front of the chemical formulas to adjust the number of atoms so they will be the same on both sides. When balancing equations, you never change subscripts. You add coefficients. Coefficients are whole number multipliers. If, for example, you write 2 H_2O , that means you have 2 times the number of atoms in each water molecule, which would be 4 hydrogen atoms and 2 oxygen atoms. As with subscripts, you don't write the coefficient of "1", so if you don't see a coefficient, it means there is one molecule. There is a strategy that will help you balance equations more quickly. It is called balancing by inspection. Basically, you look at how many atoms you have on each side of the equation and add coefficients to the molecules to balance out the number of atoms. Balance atoms present in a single molecule of reactant and product first. Balance any oxygen or hydrogen atoms last. In the example: $\text{Fe} + \text{O}_2 \rightarrow \text{Fe}_2\text{O}_3$ Iron is present in one reactant and one product, so balance its atoms first. There is one atom of iron on the left and two on the right, so you might think putting 2 Fe on the left would work. While that would balance iron, you already know you're going to have to adjust oxygen, too, because it isn't balanced. By inspection (i.e., looking at it), you know you have to discard a coefficient of 2 for some higher number. 3 Fe doesn't work on the left because you can't put a coefficient in front of Fe_2O_3 that would balance it. 4 Fe works, if you then add a coefficient of 2 in front of the rust (iron oxide) molecule, making it 2 Fe_2O_3 . This gives you: $4 \text{Fe} + \text{O}_2 \rightarrow 2 \text{Fe}_2\text{O}_3$ Iron is balanced, with 4 atoms of iron on each side of the equation. Next you need to balance oxygen. This is the equation balanced for iron: $4 \text{Fe} + \text{O}_2 \rightarrow 2 \text{Fe}_2\text{O}_3$ When balancing chemical equations, the last step is to add coefficients to oxygen and hydrogen atoms. The reason is that they usually appear in multiple reactants and products, so if you tackle them first you're usually making extra work for yourself. Now, look at the equation (use inspection) to see which coefficient will work to balance oxygen. If you put a 2 in front of O_2 , that will give you 4 atoms of oxygen, but you have 6 atoms of oxygen in the product (coefficient of 2 multiplied by the subscript of 3). So, 2 does not work. If you try 3 O_2 , then you have 6 oxygen atoms on the reactant side and also 6 oxygen atoms on the product side. This works! The balanced chemical equation is: $4 \text{Fe} + 3 \text{O}_2 \rightarrow 2 \text{Fe}_2\text{O}_3$ Note: You could have written a balanced equation using multiples of the coefficients. For example, if you double all of the coefficients, you still have a balanced equation: $8 \text{Fe} + 6 \text{O}_2 \rightarrow 4 \text{Fe}_2\text{O}_3$ However, chemists always write the simplest equation, so check your work to make sure you can't reduce your coefficients. This is how you balance a simple chemical equation for mass. You may also need to balance equations for both mass and charge. Also, you may need to indicate the state of matter (solid, liquid, aqueous, gas) of reactants and products. Balanced Equations with States of Matter (plus examples) Step By Step Instructions for Balancing Oxidation-Reduction Equations

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